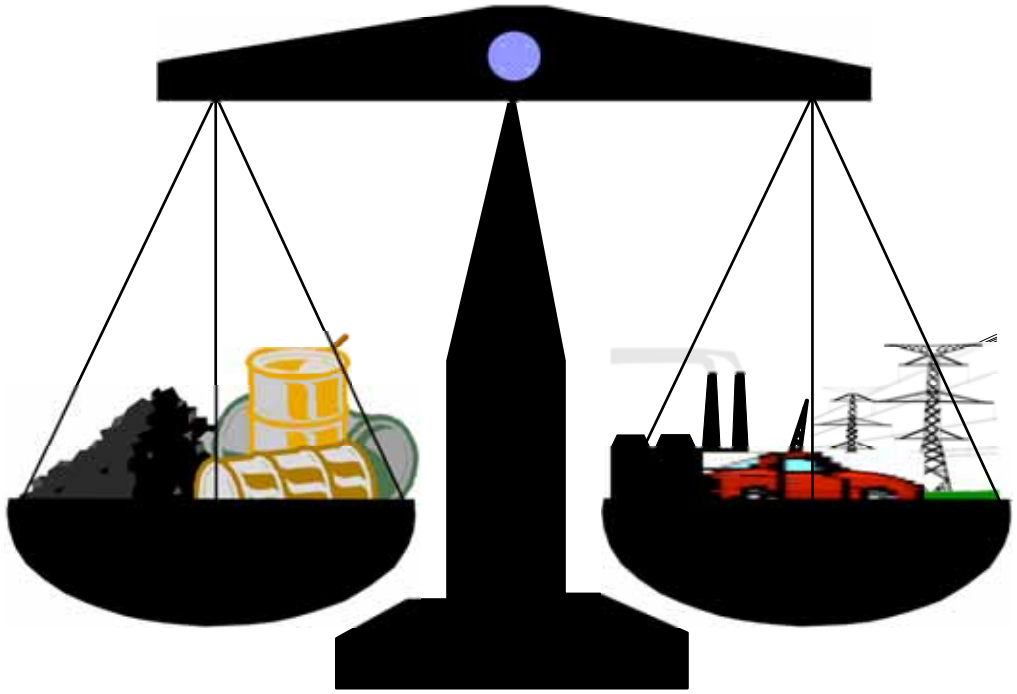
California Energy Balances (CALEB)



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Goals of the CALEB Project

- Provide a complete picture of energy use in California at the most detail level possible in term of end use consumption
- Centralize energy data on supply and demand for the State of California
- “Reconcile” different sources of data (EIA, CEC, Utilities, Surveys, Independent reporting, etc)
- Serve as a statistic resource for energy analysts and for the construction of GHG inventory
- Provide analytical tool for tracking trends in California energy use and GHG emissions (e.g. energy/emissions indicators and decomposition analysis)

Progress to Date

Phase I:

- Construction of Energy Balances in Access software from 1990 to 2004 that include data for 34 energy products disaggregated across130 different consumption categories.
- Report documenting the methodology, data sources, and the trends of energy supply and use in California over the period 1990 to 2004.

  Development of Energy Balances for the State of California, publication number CEC-500-2005-068, published June 2005, authors: Scott Murtishaw, Lynn Price, Stephane de la Rue du Can, Eric Masanet, and, Jayant Sathaye

Phase II:

- Preliminary indicators database for the building sector
- Report on residential and service sector energy indicators

  Energy Consumption in California's Buildings Since 1990: An Indicators Assessment of Key Factors. publication number CEC-500-2007-077., , published July 2007, Author: Scott Murtishaw.

Energy Balance

Data Source

Main Source:

EIA and CEC Questionnaires & Surveys

Others Source:

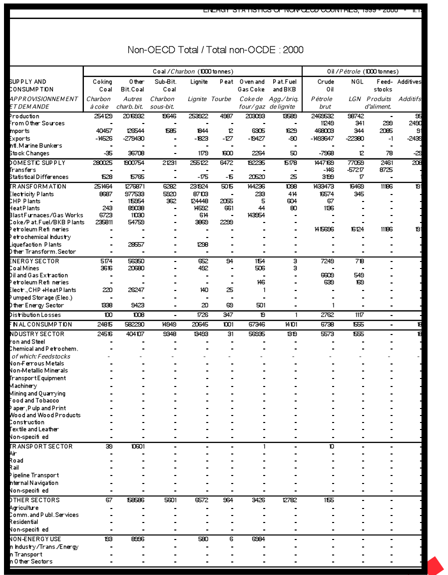
API

USGS

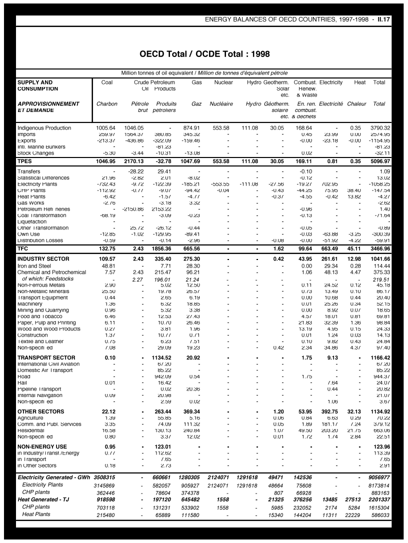
Highway Statistics

Asphalt Institute, etc

Energy Statistics
Physical units



Energy Balance
Common unit



To:	TJ	Gcal	Mtoe	MBtu	GWh
From:	multiply by:				
TJ	1	238.8	2.388×10^{-5}	947.8	0.2778
Gcal	4.1868×10^{-3}	1	10^{-7}	3.968	1.163×10^{-3}
Mtoe	4.1868×10^{4}	10^{7}	1	3.968×10^{7}	11630
MBtu	1.0551×10^{-3}	0.252	2.52×10^{-8}	1	2.931×10^{-4}
GWh	3.6	860	8.6×10^{-5}	3412	1

Conversion factors

California Energy Balance 2000

Primary & Secondary products

TBtu	Nat Gas	NGL	Crude & Additives	Petro Prods	Coal	Nuclear	Hydro	Other Ren	Biomass	Electricity	Total
Energy Supply	2,252	32	3,965	-589	136	364	134	434	90	247	7,095
Indigenous Production	357	32	1,795	0	0	364	134	434	85	0	3,201
Import	1,885	0	2,224	470	135	0	0	0	5	247	4,966
Export	-37	0	-39	-782	0	0	0	0	0	0	-858
Marine Bunkers	0	0	0	-242	0	0	0	0	0	0	-242
Net Stock Withdrawal	47	0	-15	-5	1	0	0	0	0	0	28
Statistical Differences	226	-6	4	-88	-64	0	0	0	1	17	90
Transformation Sector	-978	-15	-3,969	4,078	-24	-364	-134	-434	-91	710	-1,220
Electric Sector	-942	0	0	-50	-24	-364	-134	-434	-85	710	-1,322
CHP, Commercial Power	-13	0	0	0	0	0	0	0	0	6	-8
CHP, Electric Power	-151	0	0	-10	-21	0	0	0	0	79	-103
CHP, Industrial Power	-90	0	0	-24	-3	0	0	0	0	57	-61
Electric Generators, Utilities	-130	0	0	-2	0	-364	-130	0	0	292	-332
Electric Generators, IPP	-558	0	0	-14	0	0	-4	0	0	200	-377
Non-specified (Elec. Generation)	0	0	0	0	0	0	0	-434	-85	77	-442
Oil Refineries	-36	-15	-3,969	4,128	0	0	0	0	-6	0	103
Energy Sector	-390	0	0	-312	0	0	0	0	0	-34	-736
Power Plants' Own Use	0	0	0	0	0	0	0	0	0	0	0
Oil Refineries' Own Use	-106	0	0	-311	0	0	0	0	0	-21	-437
Oil and Gas Extraction	-285	0	0	-1	0	0	0	0	0	-13	-299
Distribution Losses	0	0	0	0	0	0	0	0	0	-77	-77
End Use Sector Consumption	1,110	12	0	3,119	48	0	0	0	0	863	5,152
Agriculture	18	0	0	61	0	0	0	0	0	22	101
Mining	6	0	0	0	0	0	0	0	0	3	9
Manufacturing Sector	231	12	0	99	47	0	0	0	0	136	524
Transport Sector	13	0	0	2,741	0	0	0	0	0	8	2,762
Services	299	0	0	21	1	0	0	0	0	375	695
Residential	529	0	0	27	0	0	0	0	0	275	831
Non-specified (Other Sector)	14	0	0	0	0	0	0	0	0	45	59
Non-Energy Use	0	0	0	170	0	0	0	0	0	0	170
Electricity Output in GWh	103,236	0	0	5,527	2,364	35,176	39,272	16,341	6,184	0	208,100
CHP, Commercial Power (GWh)	1,710	0	0	1	0	0	8	0	0	0	1,719
CHP, Electric Power (GWh)	20,188	0	0	961	1,902	0	0	0	0	0	23,051
CHP, Industrial Power (GWh)	12,592	0	0	3,095	461	0	0	22	0	0	16,570
Electric Generators, Utilities (GWh)	12,412	0	0	145	0	35,176	37,980	0	0	0	85,713
Electric Generators, IPP (GWh)	55,934	0	0	1,325	0	0	1,284	0	0	0	58,543
Non-specified (Elec. Generation, GWh)	0	0	0	0	0	0	0	16,319	6,184	0	22,503

Supply side

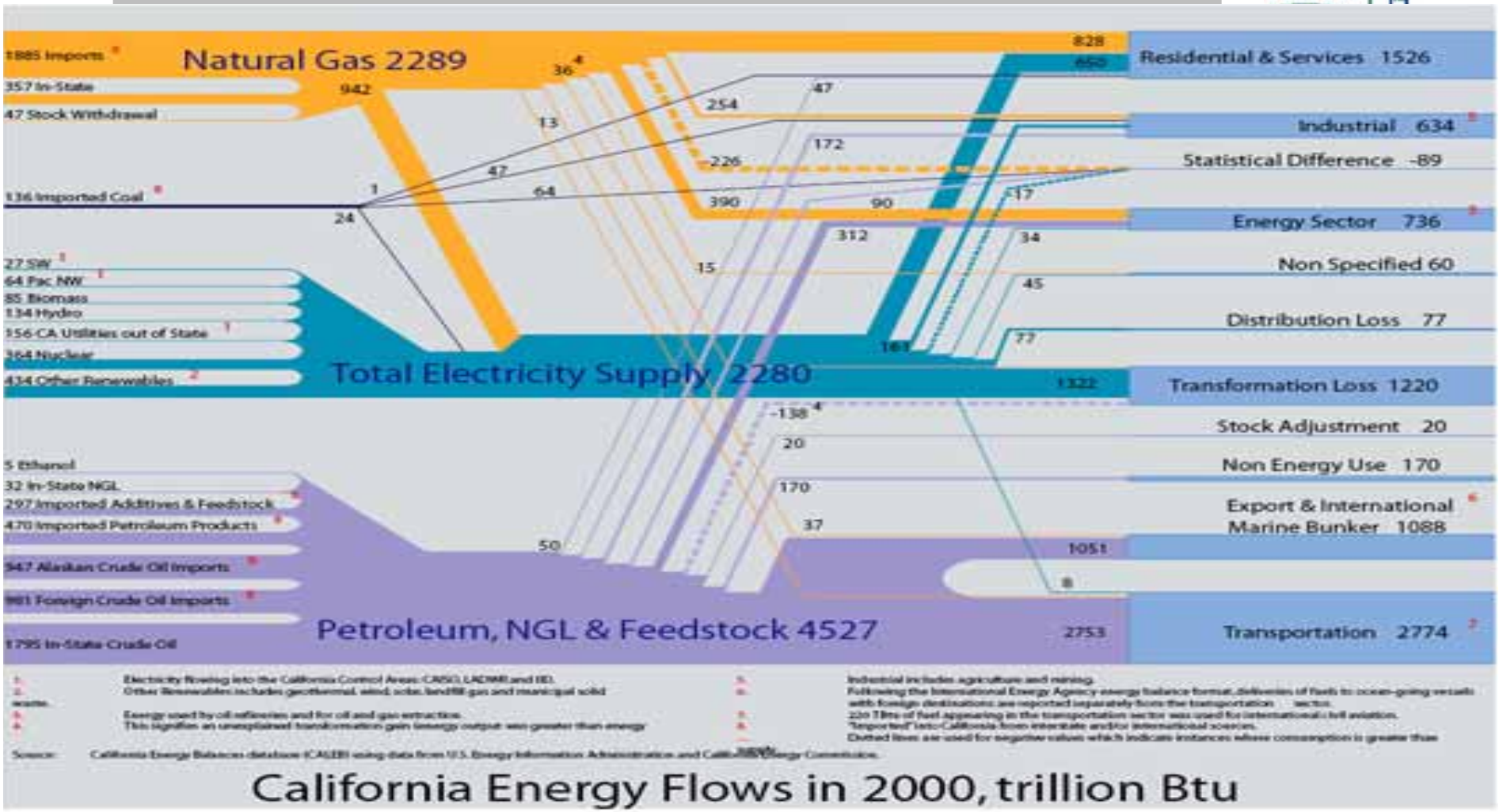
- Production
- Imports - Exports
- Bunkers & Stock Change

Demand side

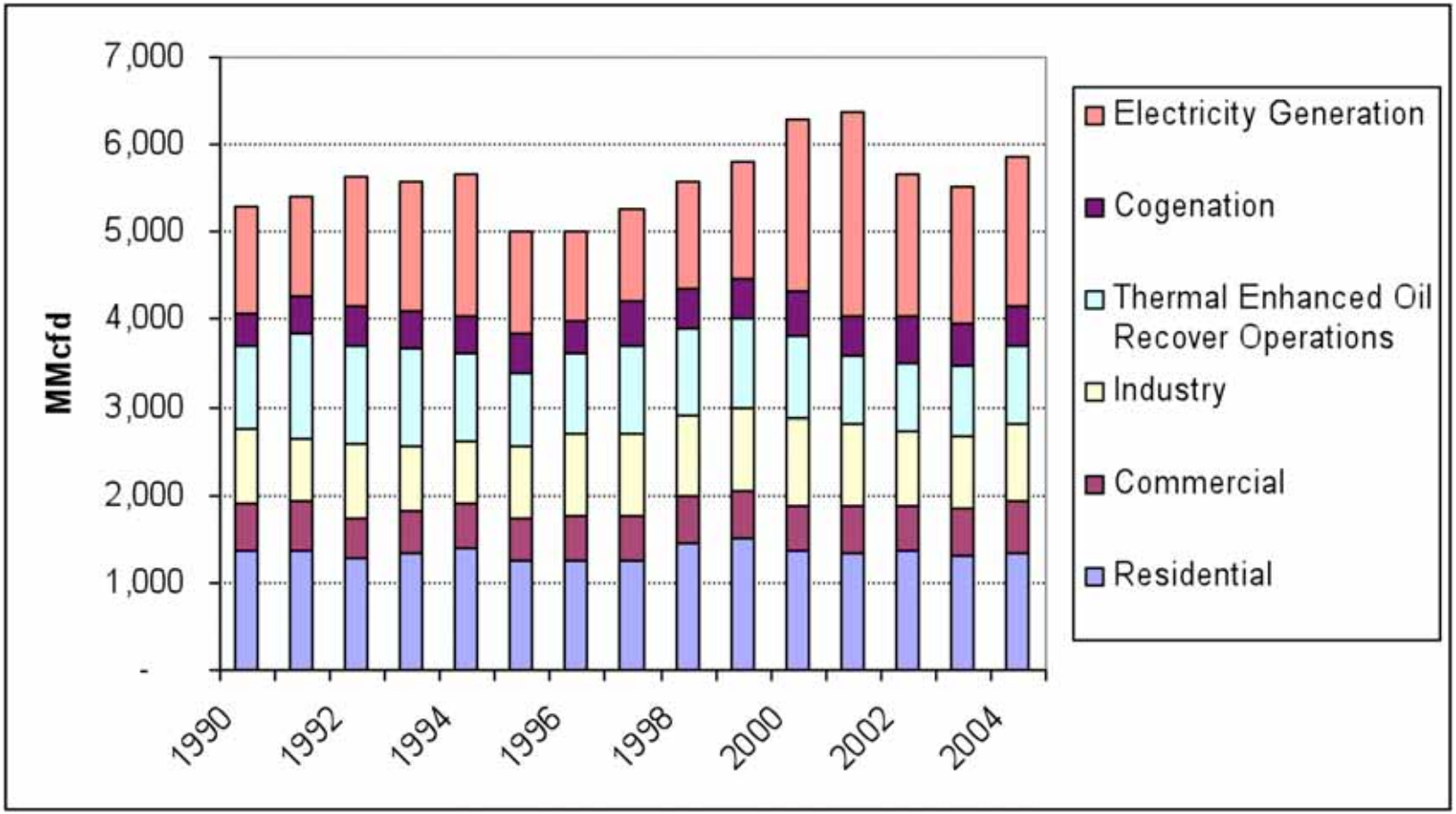
- Transformation & Energy
  Utilities, IPP, Refineries, oil and gas extraction.
- Final Consumption
  Industry, Transport, Agriculture, Residential, Commercial and Public Services)

Electricity Output

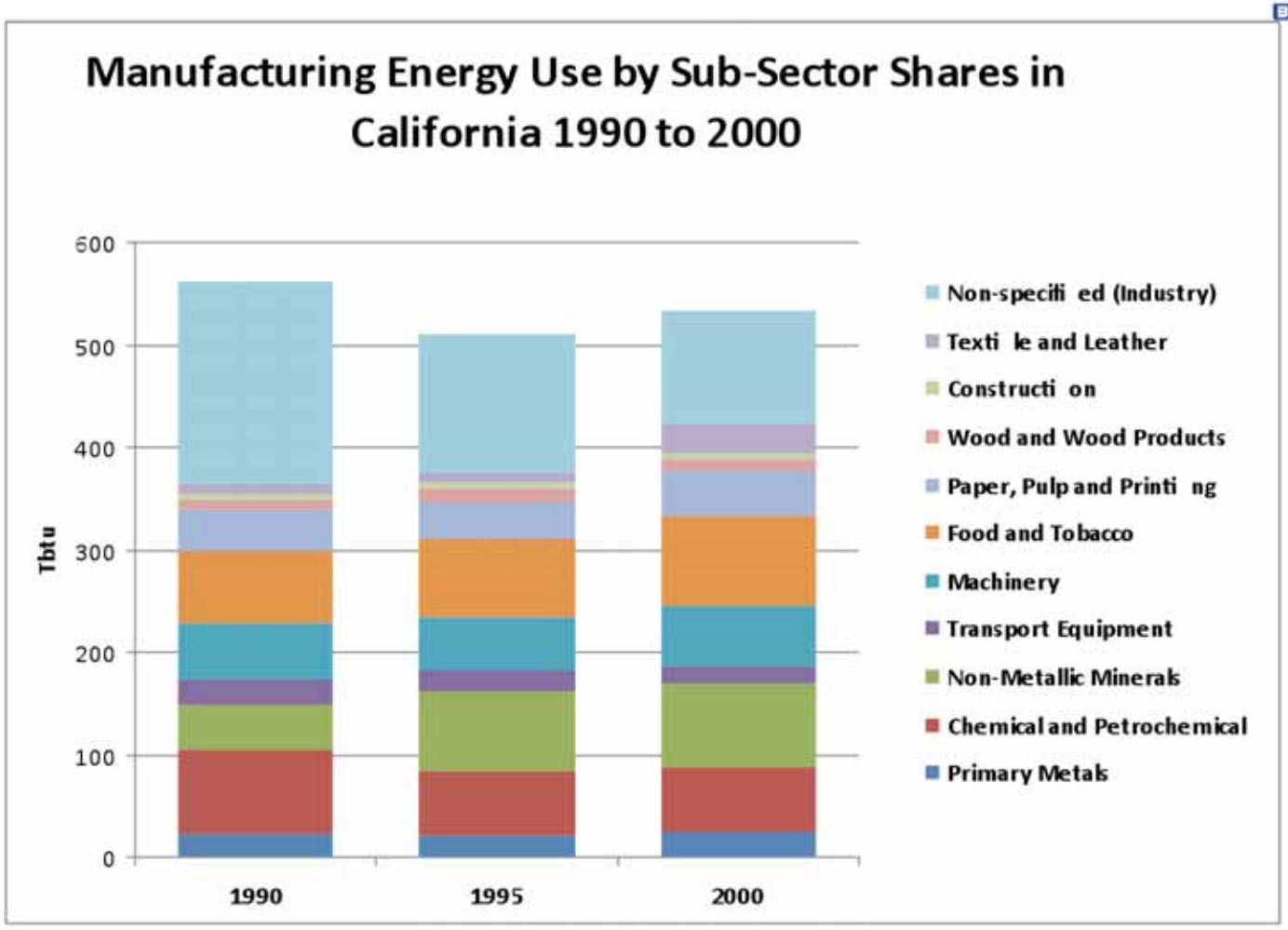
California Energy Flow



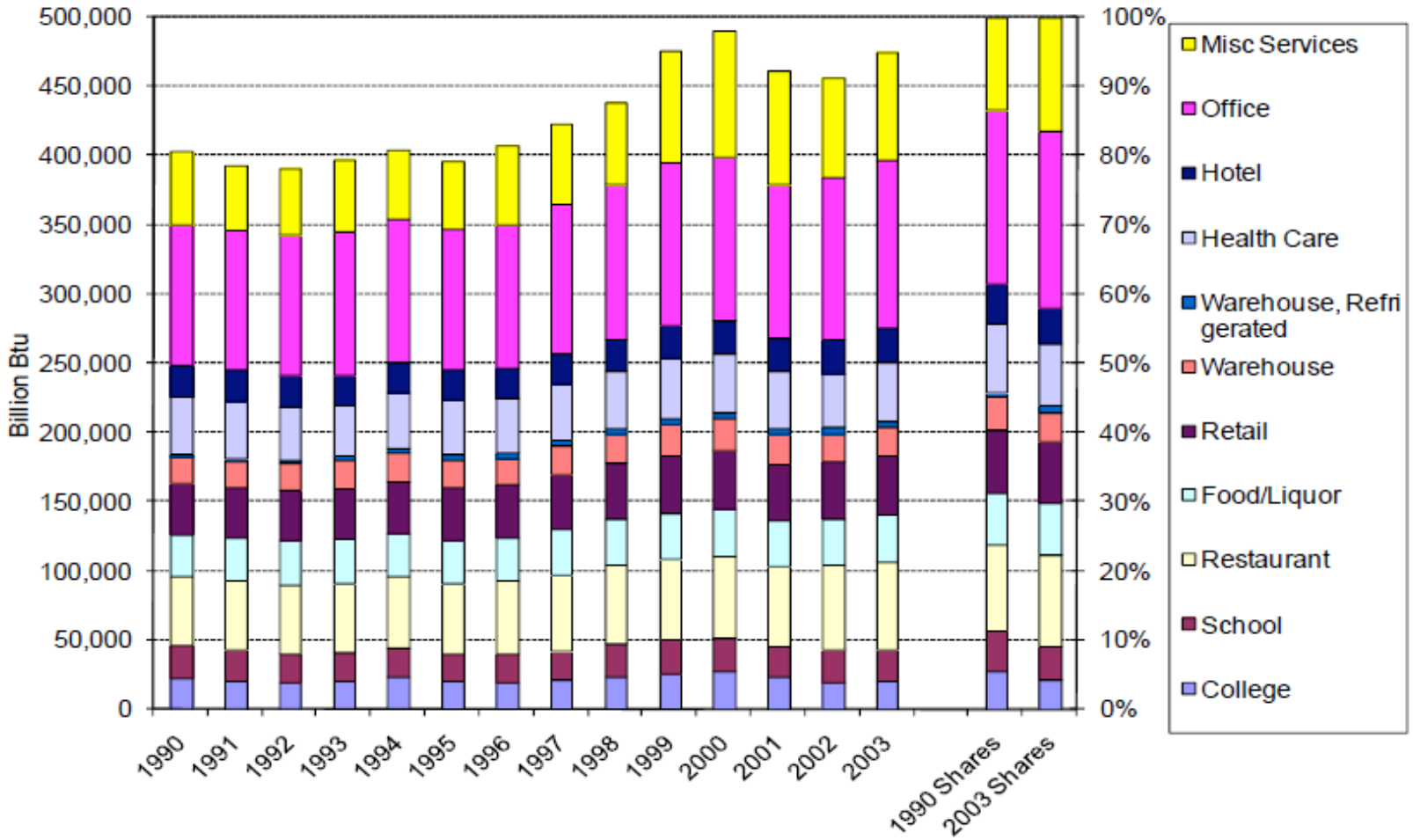
Trend Analysis: Natural Gas Consumption



Example of Sectoral Detail: Industry



Example of Sectoral Detail: Services



Energy Indicators

Indicator analysis match energy use with activity data to look at trend in energy intensity and structural changes at end use or sub sectoral level.

Example of indicators:

- space heating residential energy use per square foot in residential home,
- gasoline consumption per vehicle km for cars,
- diesel consumption per ton km for freight trucks, etc

Shortcomings Encountered

- **Petroleum Products:**
  - Data on import/export to other states is difficult to gather
  - Data on consumption is scarce for some fuel (LPG, residual fuel, Distillate Fuel Oil, solvents, etc..)
  - Disaggregating petroleum products used for electricity generation,
- **CHP:**
  - Energy use by CHP for production of electricity versus heat.
  - Estimating fuel used for CHP heat for previous to 1998,
- **Add imported/exported electricity**
- **make improvements in coordination with the California Air Resource Board GHG inventory working staff**

Phase Next Steps

- Update CA energy balance up to 2007 or 2008 depending on data availability
- Make improvements to the data set in coordination with the California Air Resource Board GHG inventory working staff
- Reconcile different sources of data
- Supplement the energy database with Activity Data (GDP, sectoral value added, floor area, households, etc.)
- Construct indicators to analyze past energy trends in the building and industrial sectors